Phase III, enhancement of selected core concept to complete concepts and Phase IV, overall and concept component evaluation, are to be scheduled.

3. **Contributors:** P Callaham, J Jones, T. Cutler, P. Gauvin, E. Gee, T. Lynn, M. Mahan, H. Spielberg, J. Spruill, B. Stevens, D. Patton

B. **Strategy:** Determine if new packaging concepts would add value and quality to existing full–margin brands thus, potentially slowing down the switching rates from full–margin to price value.

1. **Results:** A large scale consumer research proposal to look at aluminum and plastic materials was presented.

2. **Plans:**

- Conduct large scale consumer research.
- Determine feasibility of making drawn versus folded aluminum versus plastic packaging.
- Conduct an internal usage test on booklet pack.

3. **Contributors:** P. Callaham, J Jones, J. Tindall, R. Newsome, D. Wilder, E. Wooldridge, C, Altizer, A. Lopez, P. Gauvin, L. Gregory, C. Hansen, E, Gee

C. **Strategy:** Conduct studies to further the understanding of low sidestream and low odor efficacy and sensory cost/benefit.

1. **Results:** Analysis of lingering odor for the control, low odor, low sidestream, and low odor/low sidestream models showed cigarette model differences were room/material dependent.

2. **Plans:** Results will be reviewed and future research needs determined.

3. **Contributors:** C. Kuesten,

D. **Strategy:** Create a communication vehicle between the sales force, R&D, and Marketing which encourages the sales force to listen for and share potential product concepts and issues.

1. **Results:** None to date.

2. **Plans:**

- Interview Marlboro Adventure Team participants and sales force.
- Design mailer as a vehicle for sales force to communicate with R&D and Marketing.

III. **Objective:** Conduct research to develop models to predict consumer behavior and brand choice based on product, market, and demographic variables.

A. **Strategy:** Develop neural network models for switching.

2050795658

1. **Results:** The use of log–linear categorical modeling identified key relationships between switching propensity and several of the demographic and product factors, including: gender, age, race, income, marital status, Nielsen county, cigarette length, and packing type. Neural network modeling is also being performed to complement the statistical analysis. A set of neural network models was developed to predict (1) the probability or likelihood of switching, (2) the post–switch brand attributes, and (3) the post–switch brand family—as a function of the pre–switch brand attributes and pre–switch brand family. Separate neural networks were developed for each post–switch brand attribute (cigarette length, menthol, packing type, tipping color, price, and tar level). These neural network models are being incorporated into a brand switching decision support system for potential use in consumer research, direct marketing, brand management, and product design.

2. **Plans:** Develop a set of neural network models to predict brand switching behavior as a function of smoker demographics as well as smoker demographics and product attributes. Statistically analyze data from the 1991–92 Tracking Study to determine the impact of smoker demographics and product attributes on the kind of brand switch that is made—e.g., how does a smoker's decision to switch to a different tar level or price category depend on the smoker's demographics and pre–switch brand attributes? Statistically analyze data from the 1991–92 Tracking Study to determine the impact of smoker demographics and product attributes on alternate brand purchases.

3. **Contributors**: J. Blankinship, M. Johnston

4. **References:** Report 93–003

IV. **Objective:** Develop methods to quantify the cost/benefit relationship between potential benefits and consumers' desires.

A. **Strategy:** Determine the relative importance of known benefits to the consumer and the cost tradeoffs that the consumer would be willing to accept for these benefits to determine whether ideas have good marketplace potential.

1. **Results:** Cost/benefit research has been planned. An internal pretest is awaiting approval.

2. **Plans:** An internal pretest will be conducted in March to be followed by consumer testing.

3. **Contributors:** D. Ennis, E. Gee, M. Jeltema, J. Jones, A. Manwaring, J. Tindall

B. **Strategy:** Develop methods to determine the relationship between changes that will involve sensory cost and their impact on marketplace purchase.

1. **Results:** A method has been proposed.

2. **Plans:** The proposal will be reviewed for approval in June.

2050795659

3. **Contributors:** M. Jeltema, J. Tindall

V. **Objective:** Maintain a knowledge base of the importance to consumers of product attributes

A. **Strategy:** Define sensorially a smoker's view of deep discount brands.

1. **Results:** Three Basic cigarettes (Philip Morris' Black & White cigarettes) and 1 G.P.C. (Brown & Williamson's Black & White cigarettes) have been tested to date.

2. **Plans:** The following 9 tests are scheduled for the 85mm and 100mm Nonmenthol Panels:

Full Flavor 85mm Nonmenthol Panel	5 Tests
Full Flavor 100mm Nonmenthol Panel	2 Tests
Flavor Low 100mm Nonmenthol Panel	2 Tests

3. **Contributors:** A. Manwaring, B. Joyner

B. **Strategy:** Obtain consensus on Control Regions for current and future Marlboro testing.

1. **Results:** The research proposal for the unovertipped single pack testing is being developed and will be reviewed with the other contributors by the end of March. A working definition of the monitoring procedure is being finalized.

2. **Plans:** More tests of Marlboro controls from the different factories, as well as the unovertipped single pack testing are planned for the months of May and June. Plans for the testing methodology (resources to be allocated for monitoring) will be finalized in April.

3. **Contributors:** D. Atkinson, R. Cox, R. Heretick, M. Jeltema, A. Smith, H. Spielberg, J. Tindall, M. White.

C. **Strategy:** Determine whether strength ratings are adequately described by an overall panel ratings and regression based on tar per puff.

1. **Results:** Using global monadic data, a determination of whether differences exist in the way smoker categories (full–flavor, flavor–low, ultra–low) rate strength is underway. The development and evaluation of strength scores by smoker group, tar per puff, and nicotine has not been completed to date. Graphs of strength regressions of nicotine per puff versus tar per puff have been done to determine which criteria should be used to predict strength ratings. Evaluation of these regressions is to be done.

2. **Plans:** Results from evaluation of all data will be reported collectively.

3. **Contributors:** B. Joyner, J. Tindall

D. **Strategy:** Evaluate effect of repacking mentholated cigarettes on liking/menthol ratings.

1. **Results:** Menthol–in–smoke deliveries (before and after overtipping) for production cigarettes and cigarettes made in semi–works with comparable production dates have been reviewed.

2. **Plans:** Deliveries on a menthol–per–puff basis which takes into account the differences in puff count for before overtipping and after overtipping will be reviewed.

3. **Contributors:** M. Fleming, D. Atkinson, D. Birdsong

E. **Strategy:** Determine factors affecting degree of liking deficit by changing tipping color.

1. **Results:** No additional work has been conducted this quarter.

2. **Plans:** Review 85mm and 100mm lights smokers' liking ratings of cork and white–tipped cigarettes.

3. **Contributors:** M. Fleming

VI. **Objective:** Work to continuously improve our sensory methodologies.

A. **Strategy:** Establish database of POL data as an accessible, usable, and reliable data management tool.

1. **Results:** Work has progressed on the verification and validation of the POLComplete database. A draft of the user's guide which illustrates the screens, examples of SQL language, and specifics programmed to interact with the database is completed. The Sensory Research group is working with the Apt Screens to generate views and studies for current programs and editing Excel spreadsheets of the data. CAD will read this corrected data back into the database.

2. **Plans:** Plans are to complete the POLComplete database verification by the end of March. Functions which feed the database will be verified by checking results feed to the database against current analysis results. Weekly meetings are being held Friday afternoons to review progress and or problems as they arise. CAD is currently restructuring the database to deliver a more comprehensive and flexible data management tool to PED. SAS Access, Data Pivot ,and Data Prism software will be examined as software tools to expand the ease of access and utility of the database.

3. **Contributors:** M. Fleming, B. Joyner, C. Kuesten, A. Manwaring, F. Scott, A. Smith

B. **Strategy:** Computerize NPP single puff sensory methodology.

1. **Results:** A Hypercard protoype which guides panelists activities' (lighting, machine puffing, and smoking) pairs of cigarettes for same–difference judgements

has been built. The program is designed to: 1) provide instructional and timing assistance, 2) maintain panelist attention, and 3) provide feedback on performance. Various formatted output files are generated to facilitate data assimilation and analysis.

2. **Plans:** Future plans include further refinement of the existing prototype and development of higher level control functions for test design and analysis. Search, selection, and acquisition of hardware and software to implement the system will be pursued.

3. **Contributors:** C. Kuesten

Strategy: Evaluate panelists' behavior in POL testing to gain information that will help improve future test and ballot designs as well as help improve our panelist selection process.

4. **Results:** A literature search was conducted to determine whether similar studies have been conducted either internally or externally. Currently, responses to brand usage questions among switchers in a recent POL test are being reviewed to form some hypotheses on panelists understanding of brand questions and the kinds of switching patterns they exhibit.

5. **Plans:** Review articles from external literature search and continue to review responses to brand usage questions.

6. **Contributors:** M. Fleming, P. Martin, F. West

C. **Strategy:** Implement a trial cross training program that is a minimum of 6 months and maximum of 1 year.

1. **Results:** A proposal has been written.

2. **Plans:** Present proposal for acceptance and begin training.

3. **Contributors:** A. Manwaring, J. Spruill, M. Jeltema, C. Altizer

D. **Strategy:** Evaluate Excel and Deltagraph to determine whether they meet the technical needs of our group.

1. **Results:** DeltaGraph learning is in progress.

2. **Plans:** Complete learning of DeltaGraph by end of May and Excel by end of June.

3. **Contributors:** F. Scott

E. **Strategy:** Compare NPP results versus POL results to determine how differences found from NPP single puff methodology compare to consumer test results.

1. **Results:** Background information is being gathered.

2. **Plans:** Develop a proposal and obtain consensus on the methodology by May.

2050795693

3. **Contributors:** B. Joyner, M. Jeltema, D. Ennis, C. Hayes, S. Clark, T.Callaham

F. **Strategy:** Recruit and maintain a panel that is geographically and demographically representative by brand to conduct 60 Marlboro Monadic Studies and 120 Global Monadic Studies.

1. **Results:** During the first quarter, 51 POL Product Tests were mailed and 31,312 Recruitment Applications to potential panelists were mailed.

2. **Plans:** Continue to determine selection criteria for each recruitment mailout based on current panel needs, mail out recruitment letters to potential target panelists, and evaluating methods to improve selection criteria based on switching patterns.

3. **Contributors:** F. West, F. Warner, M. Jeltema, M. Fleming, M. Radzom

G. **Strategy:** Continuously update POL database with current information on panelists to assure returns of at least 70%. Potential target panelists will be PreScreened every two months and mailed either a Brand Update or Repoll Survey. New panelists will be welcomed to the panel with a Brand Update Survey. Panelists not responding to a POL Product Test will be sent a Tracer Letter.

1. **Results:** During the first quarter, 73,940 potential target panelists were mailed a PreScreen Survey, 26,202 new panelists were mailed a Welcome Test, and 25,755 non–responsive panelists were mailed a Tracer Letter.

2. **Plans:** Continue to target potential panelists for a POL Test with a PreScreen, Welcome Letter, Brand Update, Repoll Survey, or Tracer Letter.

3. **Contributors:** F. West, F. Warner

VII. **Objective:** Continuous Improvement of POL Databases.

A. **Strategy:** Improve the efficiency and effectiveness of the POL Databases.

1. **Results:** No progress to report to date.

2. **Plans:** 1. Implement interactive link for all PED Databases and to other R&D Databases. 2. Eliminate data entry of generic information shared with PED by other database users outside of PED. 3. Develop and propose plan to emulate current POL Database and POL Complete Database for Internal Panels (Japan, Hong Kong, Korea, Australia).

3. **Contributors:** F. West, M. Radzom, D. Birdsong, J. Jones

B. **Strategy:** Restructure POL Database.

1. **Results:** Scheduled to be completed by April 1, 1993 CAD–Phase 1 which includes new processing editors, full implementation of UPC Codes, expansion of select capabilities to allow more flexibility, and modification of key tables to enhance maintenance capabilities.

2050785963

2. **Plans:** CAD–Phase 2 project, which includes the evaluation and implementation of end–user database access and analysis tools, is scheduled to start April 1, 1993.

3. **Contributors:** F. West, C. Kuesten, M. Radzom

INTERNATIONAL

VIII. **Objective:** Investigate marketplace dynamics and Asian consumer lifestyles, behavior, attitudes and product perceptions.

A. **Strategy:** Identify forces that impact market share in our International markets.

1. **Results:** Market share data files have been updated based on our most recent share information for Japan, Korea, Hong Kong, and Malaysia. Graphs have been generated representing historical trends for the key domestic and imported brands and packings by country. Additional data files have been established and maintained for Singapore, Taiwan, and the Philippines.

2. **Plans:** Meet with PMI Information System representatives on March 17 to evaluate feasibility for on–line access to market share data for Japan, Korea, Hong Kong, and Malaysia. Obtain market share data and establish databases for Australia to supplement our support for the new Australian Consumer Panel.

3. **Contributors:** C. Matthews, D. Purvis

B. **Strategy:** Conduct/monitor in–depth research to understand consumers' attitudes, lifestyles, behavior, and potential interest in product benefits.

1. **Results:** Existing qualitative and quantitative information has been reviewed to assess what we currently understand about the profile of the Japanese Caster family (focus on Caster Mild) smokers.

2. **Plans:** Discuss insights on the Caster family smokers with PMKK; determine what additional information is necessary and propose methods for obtaining those data. Conduct a similar review of information on Japanese Frontier Lights smokers, particularly to address their choice process and benefit perceptions important in motivating brand switching. Plans are to discuss research proposals with PMKK for quantifying consumers' self–reported brand choice attributions, thereby identifying salient product and packaging benefits. In Hong Kong and Korea, we will propose procedures for assessing smokers' interest in various product benefits, by segment, to provide direction for product opportunities.

3. **Contributors:** C. Matthews, D. Purvis, J. Jones

IX. **Objective:** Evaluate product features for perceived benefits/added value.

A. **Strategy:** Investigate methods to generate/evaluate new product ideas; assist in concept/prototype research design.

1. **Results:** Currently, a new methodology for concept generation/evaluation is under investigation in the U.S., with potential application for PMKK.

2050795664

2. **Plans:** Product/concept testing procedures are being discussed for use in menthol programs in Hong Kong and Japan.

3. **Contributors:** J. Jones, C. Matthews, J. Smith

B. **Strategy:** Obtain and evaluate consumer information relating to the product benefit themes of social acceptability and packaging.

1. **Results:** Discussions have been held relating to the development of an optimal design for the pre–placement of sidestream modified products in Japan to be followed by a series of focus groups among pre–placement participants.

2. **Plans:** Conduct a low smoke/low odor extended use study in Japan, with concept, to assess product opportunities. Conduct focus group research and new packaging qualitative research in Japan to assess attributes viewed as potential benefits.

3. **Contributors:** J. Jones, C. Matthews, J. Smith, PMKK, ASI Marketing

X. **Objective:** Insure the validity, reliability, and effectiveness of PM–International's subjective testing program through theoretical and applied methodological research.

A. **Strategy:** Evaluate and implement improvements in Asian panel data collection methods.

1. **Results:** 1993 testing schedules, outlined by program and smoker groups, have been proposed to PMKK and PM Asia. An analysis of product construction/analytical factors that may influence the sensory responses of Korean smokers is in progress.

2. **Plans:** Evaluate the performance of the newly established Malaysian Consumer Panel by early May and the proposed Australian Consumer panel by July. Assess nonsensory product features that may influence sensory ratings in Malaysia and Australia. Evaluate the data from each Asian consumer panel to determine the effect of procedural design parameters, with product construction/analytical factors, on sensory response.

3. **Contributors:** C. Matthews, M. Ferro, J. Jones, J. Smith, R. Slagle, PMKK, PM Asia, CAD

B. **Strategy:** Manage databases to improve efficiency of analysis.

1. **Results:** Progress continues on modifications designed to streamline the current analyses programs (target completion date April). The monitoring of marketplace brand changes and control databases continues on an ongoing basis.

2. **Plans:** Establish databases of sensory ratings and analyticals for Malaysia and Australia consumer panels.

3. **Contributors:** C. Matthews, D. Purvis, M. Ferro

C. **Strategy:** Improve data presentation effectiveness.

2050795665

1. **Results:** For each consumer panel and smoker group, the capability to plot own brand ellipse relative to major competitors and relative to brand family extensions is maintained on an ongoing basis.

2. **Plans:** Implement technology transfer of analysis methodologies to PMKK and PM Asia. Present project summaries by means of on–line computer projections.

3. **Contributors:** C. Matthews, D. Purvis, CAD

XI. Objective: Maintain external consumer panels to conduct sensory research.

A. **Strategy:** Assure that PMKK, PM Asia, and the sensory research vendors understand R&D's expectations.

1. **Results:** The smoker group pool in Japan has been supplemented to meet the requirements of our Ultra Lights program. Menthol Panel modifications in Japan have been proposed to PMKK. The Malaysian Ramadan (Muslim fasting period) scheduling issue surrounding testing of Chesterfield has been addressed.

2. **Plans:** Monitor processes involved in "pooling" Danchi panelists. Visit current contract research houses to review all panel issues. On an ongoing basis and in conjunction with the regions, identify research programs which require supplementing our panel compositions, and communicate requests and timetables to vendors.

3. **Contributors:** C. Matthews, J. Jones, M. Ferro, D. Purvis, Export PD, PMKK, PM Asia, ASI, Hankook, MDR, Consumer Probe

2050795666

PROGRAM NAME : New Primary Technology
PROGRAM COORD. : S. E. Clark
PREPARED BY : C. A. Wood
PERIOD COVERED : First Quarter, 1993

Coordinator Summary: The BRICA Cost Reduction team was formed in December to qualify the BRICA 4 blend change in February. The blend change has been implemented in the factories. The team is working toward a recommendation for implementing steam tunnels for BRICA based products by the end of March. They will continue to work towards a recommendation to reduce the cost/1000 cigarettes for BRICA 4 products by $0.44 over the November 1992 base cost.

Modifications to the Semiworks were completed which permit development of DCC casing, strip heating, filler blending and tub blending operations. All are proceeding according to schedule.

Single puff smoking techniques have continued to be used to evaluate subjective differences attributed to process operating conditions.

Investigations into the impact of cut width, strand length and enhanced C.V. BBO have been initiated to develop appropriate relationships between component geometry and cigarette filling value.

I. Objective: Develop a process for preparing blend components individually or in selected combinations which manages the interactive objectives of maximizing the cigarettes produced per pound of tobacco utilized and achieving subjective acceptability of the blend.

A. Strategy: Utilizing various blending techniques, demonstrate that individually processed components can be blended to a degree of uniformity that is at least comparable to current total blend process methods.

1. Results: To date, studies utilizing natural chemical markers and picking analysis of the cigarettes have found no blend differences between cigarettes produced via individual component processing (ICP) and conventional total blend strip processing.

FTIR (Fourier Transform Infrared Spectroscopy) and XRF (X–Ray Fluorescence) analysis of the six Bokelman sample sets for DBC were completed to generate a system calibration and determine the level of precision for the eight blend components. BRICA blend components have been provided to generate the calibration sample sets for BRICA blend determinations and are in the process of being mixed and analyzed. Standard deviations from the FTIR analysis or from the combined FTIR/XRF analysis will be used to measure blend variations on a cigarette to cigarette basis.

Both in–line blending and tub blending systems have been installed and checked out in Semiworks. Cigarettes have been made to compare blending performance versus standard blend methods. FTIR, XRF, and picking analyses are planned for blending comparisons.

Two Strand Geometry trials have been conducted to evaluate blending performance of controlled strand length cut components, and in particular, RL and

RCB. Cut width and strand length have been varied to provide improved feeding and blending of cut recon components. FTIR, XRF, and picking analyses will be performed to measure blend consistency.

2. **Plans:** FTIR and XRF data sets will be completed for BRICA components to generate standard values for known blend component ratios. The technique will be qualified to determine rod to rod variation between different blending scenarios.

   Complete testing of samples from the in–line blending and tub blending tests and evaluate the results to confirm that blending comparable to conventional processing is achieved. Measure degradation profiles through the in–line blending system as compared to standard total blend processes and modify the system, if necessary.

   Additional Strand Geometry samples from ICP processing will be generated to refine component cut width and strand length for combinations that facilitate achieving blend uniformity.

3. **Conclusions:** Blending performance of the various Primary Technology processes which have been demonstrated to date must be confirmed through FTIR and XRF methods on a cigarette to cigarette sample basis. The validity of the methodology for determination of individual cigarette blend uniformity is expected within the next eight weeks.

4. **Contributors:** C. Harward, D. Lisbon, R. Mullins, B. Kanipe, B. Martin, P. Kurth

B. **Strategy:** Identify, by component, specific operational parameters which provide improved strand length and cigarette firmness. Set priorities for unit operation activities based on their potential impact on cut component physical quality and performance.

1. **Results:** Tests designed to determine operating conditions within the current cutting/steaming/drying operation which yield maximum filling power for Bright, Burley, Oriental, and RCB have been completed in the Semiworks.

   The Legg Panda steaming tunnel has been relocated to the Semiworks, adjacent to the KGF Microwave Unit for heating strip at low OV. Panda testing in the D Pilot Plant previously showed tobacco strip can be elevated to temperatures equivalent to those achieved with the microwave without a net increase in OV. Tests have been conducted with 19% OV strip, heated via microwave and cut, versus Panda superheated steam treated material which was cut resulting in 16% and 18% OV cut filler respectively. A control BRICA blend was used for reference. Cigarette samples were fabricated for subjective and physical evaluations to aid in selecting a preferred strip heating process.

   Strip and component drying profiles have been evaluated using an existing Frigoscandia Unit in the Pilot Plant. Pilot testing has demonstrated improved OV uniformity versus conventional rotary dryers. A unit has been designed for the Semiworks to further develop drying flexibility and ICP trim drying techniques and is being considered versus other equipment options for cost and operational effectiveness.

2050795668

2. **Plans:** Cutting and drying optimization trials for RLTC and RLB are scheduled for Semiworks in March. These will complete the cutting and drying optimization of individual components.

   Low OV cutting trials have been designed where BRICA blend will be cut at low OV followed by a comparison of CV enhancement techniques using the superheated steaming Panda, microwave, or Hauni saturated steam tunnel. These trials are scheduled for April to evaluate filling power and subjective results as a function of processing steps and conditions.

   Frigoscandia drying and alternate trim drying designs are being compared prior to placing an order for a Semiworks prototype unit.

3. **Conclusions:** Individual component processing may offer improvements in filling power and physical tobacco characteristics which cannot be maximized via the conventional total blend process.

   Tobacco strip has successfully been heated and cut at a reduced moisture level using superheated steam or microwave processing with equivalent cut characteristics as conventional processes.

   These cutting and drying developments provide the tools necessary to manage process moisture profiles and establish filling power enhancement through New Primary processing techniques.

4. **Contributors:** J. Crump, J. Nepomuceno, M. Toerne, P. Aument, J. Gear, M. Ferro, P. Oglesby, A. Kumar

C. **Strategy:** Conduct laboratory analysis directed toward identifying and obtaining a better understanding of the mechanisms which influence filling power.

1. **Results:** Stress relaxation times as a function of RH and temperature have been approached by measuring creep recovery on Bright lamina at 60% RH and 23.8°C for 100, 1000, and 4000 seconds.

   Information needed to develop a computer model for the Hauni Steam Tunnel is being assembled. The model intended to predict the temperature and OV profile of tobacco shreds for a given set of steam tunnel process conditions, is being checked and verified.

2. **Plans:** Further stress relaxation measurements will be made at 15°C, 23.8°C, 40°C, and 50°C at 65% RH and 4000 seconds of applied load. Time dependent CV tests will be conducted as soon as the Borgwald instrument is automated as an approach to measuring a stiffness component of the filling value.

   The initial Hauni Steam Tunnel model development is expected by the end of March. Further enhancements will include the addition of a Rotary dryer to the model.

3. **Contributors:** A. Basak, S. Ganeriwala, P. Chen, M. Subbiah

D. **Strategy:** Develop a database to record processing parameters and to provide access to analytical data for Primary Technology samples.

2050795469

1. **Results:** Comprehensive modifications were made to the database, and the data entry forms were restructured. A User's Guide was written and New Primary personnel have been trained. The system is now being used for obtaining CI data and generating sample labels. The MEL and process data has not yet been included in the system.

2. **Plans:** Utilize the database to structure test plans, enter process information, retrieve and store test information and reports.

3. **Contributors:** A. Lewis, R. Mullins

II. **Objective:** Develop casing and flavor systems that compliment the process developed in the Primary Technology program and achieve subjective acceptability necessary to produce existing and additional value added products.

A. **Strategy:** Develop flavor systems to achieve subjective targets with individual cut component (ICP) processing.

Formulate flavor systems to reduce costs and reduce thermal treatment of flavored tobaccos through consolidation of Unit Operations. Consolidate flavor formulations to reduce cut component storage volume requirements.

1. **Results:** Marlboro models were produced with casing reformulation and reallocations to overcome sensory differences observed with earlier ICP models. The most promising model incorporates Burley top casing ingredients in the aftercut. Subjective evaluation is expected in March.

Direct Cylinder Conditioning trials are in progress to achieve acceptable applications of Bright and Burley casings in the DCC. An application algorithm was developed to compensate flavor application for strip residence time as well as startup and shutdown transients.

A new pump has been installed in the Semiworks Bright casing cylinder to test Burley casing applications to cut Burley tobacco in conjunction with DCC flavor components.

BRICA Burley Strip was collected from conventional Burley Spray cylinder (25 control and 100 test strips). The samples were analyzed using the Infrared Engineering TM55 sugar monitor. The results for this test showed no differences in the spray coverage on each side of the strip. This result may be attributed to penetration of the NIR energy through the strip. The average variances in sugar content ranged from 4% to 8%. If these variances are typical, then variances in the process can differ by a factor of 2 to 2.5 and still be considered reasonable. The variance of the mean percent sugars from strip to strip between test groups ranged from 11% to 19%.

BRICA models were produced with reduced humectants (25% and 50% reductions). Subjective parity was not achieved and dust by–products increased but cigarette weight reduction is possible if pack OV targets could be reduced.

Cased and uncased lower quality leaf samples supplied by the Leaf Department were treated with superheated and saturated steam in the Legg Panda to evaluate

subjective direction as a result of treatment to improve the subjective character of these specific tobacco grades.

The cased, Panda superheated materials were generally more smokeable than the other models. These samples were hand made, and further testing with machine made cigarettes is needed to fully evaluate the Panda's capability for subjective modifications of lower quality leaf grades.

2. **Plans:** Evaluate split Burley casing between the DCC and cut Burley application.

   Qualify the DCC as an alternative casing system to replace current systems. A run has been scheduled in early March for both the conventional and DCC processes. A test protocol similar to that described above is planned for these runs. A minimum of eighty–three samples will be collected in order to detect a 20% difference in the standard deviation between spray methods using the 95% confidence interval criteria.

   Demonstrate subjective acceptance of ICP BRICA with DCC casing and cut Burley flavoring in Semiworks.

3. **Contributors:** B. Bell, J. Sherron, M. Parrish, R. Pitts, D. Golob, D. Rockwell, P. Kurth, J. Gear, C. Moogalian

B. **Strategy:** Provide expert and consumer testing of cigarette models resulting from the development of the Primary Technology Process at various stages in its development. Establish the sensory basis for qualifying the process as a viable alternative to the current primary process and to develop an understanding of the effect of unit operation variables on cigarette sensory parameters.

1. **Results:** Overviews of the single puff smoking evaluation method and the 1992 subjective testing results from a variety of Primary Technology cigarette models were presented in January to the Product Development Directorate management and the Process Development monthly meeting. As of February 1, 1993, subjective support of the Primary Technologies (PT) Program will be coordinated by the Product Research Division (C. Hayes). "Same–Different" judgments using the single puff method continue to be used to evaluate individual component processed (ICP) models. Testing of the Oriental and Bright models has been completed and the Burley processed models are currently being evaluated. Extensive evaluations of BRICA weight–reduced cigarettes (–35 mg) were completed with both "same–different" and 2–alternative forced choice methodologies. These were conducted using single puffs, puff combinations, and whole cigarette evaluations. Small or no sensory differences were noted. Subjective testing of weight–selected Marlboros (tunnel vs control) have been initiated.

   A new panel was formed to augment the PT panel and to conduct research on sensory procedures. Subjective evaluations of tunnel (Panda vs Hauni) and dryer (KLK vs Frigo) BRICA total blend cigarette models have been initiated. Evaluations comparing weight selected vs unselected models are underway and rinsing methods (between puffs vs between trials) are being investigated.

A prototype data automation system for the single puff method is being developed. A review of vendor and public domain software has been completed.

Cigarettes from Hauni treated fillers were smoked utilizing electrostatic trapping to collect smoke condensate. The condensate was fractionated and profiled by GC to reference the various condensable smoke constituents to determine if it may be feasible to reference subjective differences to GC data.

2. **Plans:** Complete the ICP testing and report the results to the PT team. Complete evaluations of weight selected tunnel–treated Marlboros and report the results. Complete and report the results of BRICA total blend evaluations. Continue evaluations of sensory procedures and begin evaluation of descriptive methodology. Continue development of computer automation. Evaluate the feasibility of mapping GC smoke condensate data to subjective characteristics.

3. **Contributors:** C. Hayes, G. McLaughlin, R. Kaiser, C. Kuesten, D. Ennis, B. Joyner, M. Buckner

III. **Objective:** Develop processing scenarios that maximize productivity, efficiency, and flexibility.

A. **Strategy:** Develop computer simulation models of New Primary technologies which can be used to optimize logistics of existing operations.

1. **Results:** Development of a simulation model of the current Cabarrus process is underway. Using actual process configurations, rules, and schedules, the model will be validated against actual production statistics. Areas currently being validated are conditioning through final filler production and expanded tobacco departments.

2. **Plans:** Complete Cabarrus validation by March. Expand the model to include cut filler silo storage and Cigarette Manufacturing by April, and develop a single integrated model by May.

3. **Contributor:** L. Haws

IV. **Objective:** Identify and recommend technologies which evolve out of the Primary Technology Program for Total Blend processing that could be implemented within existing facilities to achieve improved tobacco quality, yield and result in reduced cost per thousand cigarettes produced.

A. **Strategy:** With initial emphasis on price value products, develop new processes and product specifications to improve the tobacco weight versus firmness relationship with acceptable subjective response.

1. **Results:** A cross–functional team was formed to coordinate activities and make recommendations to increase the profitability of BRICA products while maintaining subjective acceptability and analytical as well as physical parity. These activities currently include the use of steam tunnels, planned BRICA blend evolution, casing and flavor changes, and the incorporation of expanded BRICA components in the blend.

Hauni tunnel testing to determine the impact of reduced residence time of tobacco in the tunnel was completed. Over a range of 7 to 27 seconds and bed depths of 0.5 to 1.0 inch tobacco weight reduction potential was equivalent.

The average equilibrated firmness weight savings potential was determined to be 27 mg for a BRICA blend in a King Size format.

Testing was conducted by R&D, and a contract firm to estimate the VOC impact of Hauni tunnel installations for Cabarrus and Louisville. These results are expected by March 5.

Bristol models were made and evaluated with a new lower cost blend and a reduced alcohol aftercut in Semiworks and a Cabarrus factory trial. These changes were analytically and subjectively approved and implemented in the factories for Bristol, Basic and BW/PL brands on February 26.

Bristol models were made with steam treated BRICA 4 blend and several aftercuts. Internal subjective testing to–date indicates the model with the new reduced alcohol aftercut to be within the range of subjective acceptability for discount products. A confirmation trial is in progress which will also investigate the impact of 25 cpi.

Internal testing is in progress to qualify the new BRICA 4 blend for Cambridge. A POL test has been scheduled for the week of April 5.

Filler and cigarette production is in progress for a POL test of Bristol with steam treatment of the new BRICA 4 blend and the reduced alcohol aftercut.

Other Bristol models have been made and are currently being evaluated. These include a model with lamina only steaming (recon bypassed the steam tunnel) which gave approximately the same cigarette weight reduction potential as for the total blend steamed model. Another model made with 25 cpi steamed total blend indicated a weight reduction of 47 mg in a KS 720 mg cigarette. A third model incorporated a high CV BBOSL which resulted in a cigarette weight savings of 11 mg (without total blend steaming). CI and subjective testing of these are in progress.

A financial analysis of expanding BRICA components has been performed for various inclusion levels of expanded materials. At a 10% inclusion level of expanded material in BRICA products, a cost savings of $0.07 per thousand cigarettes could be realized. The analysis also demonstrates that the steam tunnel improvements provide a greater cost savings at equivalent weight savings provided by expanded tobacco. A recommendation for Hauni tunnel installations and BRICA ET strategies are being prepared for review by the end of March.

BRICA models have been made with 10% inclusion of expanded product and are awaiting subjectives prior to further production of BRICA with expanded tobacco inclusion and Hauni Tunnel treatment.

2. **Plans:** Complete replication trial of steam treated BRICA 4 at 30 cpi and 25 cpi.

   Complete POL studies of steam treated Bristol and Cambridge (no steaming) with the new blend.

Complete testing of Bristol models with lamina only steaming, 25 cpi, and MW treated BBOSL.

Conduct testing of Bristol cigarettes with ET inclusion levels of 5%, 10%, and 15%, with and without total blend steaming.

Make recommendations for steam tunnel installations in Cabarrus and Louisville by March 31. Develop detailed tunnel specifications for factory installations.

Develop BRICA product strategies to reduce the November 1992 cost/1,000 by $0.44/1,000 by the end of 1993.

Develop and recommend an expanded tobacco strategy to fully utilize the three–plant, three–shift capacity that best suits the business needs.

3. **Contributors:** M. Buchanan, T. Callaham, M. Hoffman, T. Meade, C. Moogalian, D. Rockwell, B. Bell, J. Sherron, J. Nepomuceno, C. Wood, R. Keatts

PROGRAM NAME : Cast Leaf
PROGRAM COORD. : G. Gellatly
WRITTEN BY : G. Gellatly; R. G. Uhl
PERIOD COVERED : First Quarter, 1993

Coordinator Summary: An NBL trial was run in the BL Plant on all three lines which demonstrated the physical quality of NBL to be twice that of RCB. The slurry preparation system and the dryers of the BL Plant were also demonstrated to have the capacity for the desired increased throughput of 8,200 lbs/hr NBL (+25%). Product from these trials will be evaluated in an MF configuration by an internal panel in March. Preparation of a business plan for modernization of the BL Plant to include NBL is on schedule to be completed by December 1993.

To date, it has been found that acceptable handsheets could be made with 2–4 parts guar gum with 100% production dust ground to 95% < 120 mesh. Inclusion of ground burley stems into the feedstock indicate that the "harder" burley stem particles require a more rigorous treatment for the production of acceptable hand sheets with 2–4 parts guar gum. Overall, reduced guar gum formulations are feasible but will require improved homogenization of the slurry to improve tensile strength and prevent tobacco–binder separation during drying.

I. **Objective:** Optimize the current RCB process for improved sheet physical properties, production capacity, and environmental goals.

A. **Strategy:** Utilize the Cast Leaf Pilot Plant to develop new technology applicable to the present RCB process to improve sheet quality without changing the subjective character or delivery.

1. **Results:** Pilot plant trials defined the minimum grinding requirements for NBL feedstocks to be 95% < 120 mesh for burley stems and only 95% < 60 mesh (current grind size of BL Plant processed production dust) for production dust. NBL produced with these feedstock materials achieved equivalent slurry rheology and sheet strength compared to NBL produced with both the burley stems and production dust ground to 95% < 120 mesh. Subjective evaluation of pilot NBL produced with the new feedstocks indicated that the differences in subjective response were reduced.

2. **Plans:**
   - Qualify pilot plant for NBL.
   - Evaluate NBL production products by our internal panel at current substitution level for RCB in a Marlboro blend.

3. **Conclusions:** Subjective characteristics of RCB and NBL are sufficiently close for the remaining development trials to be run in the BL Plant.

4. **Contributors:** Reconstituted Tobacco Development, Chemical Research, Analytical Research, Physical Research, Flavor Technology, Microbiological Research, and BL Plant

2050795675

5. **References:**

   J. W. Swain, "Subjective Evaluation of NBL Trials," memo to G. Gellatly, February 17, 1993.

   P. Lieberman, "New Shear Profile for Pilot Plant Studies," memo to G. Gellatly, January 26, 1993.

B. **Strategy:** Define the potential formulation reductions of ammonia in the NBL process while maintaining the physical quality improvements of NBL and subjective parity with RCB.

1. **Results:** The physical quality of NBL made with ammonia reduced (by 33%) has been shown to be the same as standard formulation and emissions have been shown to be reduced by 33%. The subjective character of this product from the pilot plant was shown to be different from RCB. No further work on reduced ammonia NBL was done this quarter because of the greater priority to establish subjective parity of NBL with RCB. Several conditions considered to affect NBL subjective character in the pilot plant have been corrected since the last reduced ammonia NBL trials were run. Because of the progress made in closing the gap of subjective parity of NBL and RCB a plant trial of reduced ammonia is planned in April when further NBL trials are run.

2. **Plans:** Complete the trials of reduced ammonia NBL in the BL Plant.

C. **Strategy:** Develop a recommendation for the BL Plant modernization.

1. **Results:** An NBL factory trial was conducted at the BL Plant to validate pilot plant results. A full production, three dryer line trial was conducted. The feedstock materials for the trial were ground unwashed burley stems (95% < 120 mesh) and used in conjunction with standard grind production dust. The factory produced NBL had improved tensile strength (32 kg/m) compared to RCB (16 kg/m) and demonstrated the potential for debottlenecking the slurry preparation area and drying lines to support increased capacity (NBL at 390 fpm dryer line speed, 13 gm/sq. ft. sheet weight versus RCB at 350 fpm, 11.4 gm/sq. ft. sheet weight). A series of NBL materials were produce at different drying profiles to hone in on subjective parity with RCB. Marlboro blend cigarettes incorporating the test NBL were produced in February.

2. **Plans:**

   - Evaluate all NBL products in a Marlboro configuration in March by an internal panel.
   - Run further NBL trials in the BL Plant to confirm results of the January trials.
   - Evaluate blending efficiency of the existing BL Plant equipment
   - Contribute to the business plan formulation and 650 preparation for BL Plant Modernization by PM Engineering – December 1993.

2050795676

3. **Conclusions:** Production dust does not have to be ground further than at present and the present grinder has the capacity to grind the projected increased throughput on a three shift basis.

   Only a grinder for hammermilled burley stems will have to be purchased for NBL production at the BL Plant.

   No modification of the slurry preparation system of the BL Plant is necessary for the projected increased throughput of the BL Plant.

   No increased drying capacity is necessary for the projected increased throughput of the BL Plant.

4. **Contributors:** Reconstituted Tobacco Development, BL Plant, PM USA Engineering, Physical Research, and Flavor Technology

5. **References:**

   B. B. Hoskin, "Factory Trial Blend Composition," memo to M. L. Parker, January 15, 1993.

   M. L. Parker, "NBL Factory Trial Test Plan," memo to L. Murphy, January 26, 1993.

   P. Lieberman, "New Shear Profile for Pilot Plant Studies," memo to G. Gellatly, January 26, 1993.

   M. L. Parker, "NBL Factory Trial Report," memo to L. Murphy, March 4, 1993.

   M. L. Parker, "Blending Trial and Stemmery Reclaim Trial Test Plan," memo to L. Murphy, February 25, 1993.

II. **Objective:** Develop a Cast Leaf process that will provide flexibility in meeting world wide capacity needs for individual reconstituted tobacco types.

A. **Strategy:** Develop a business plan analysis for Cast Leaf utilization.

1. **Results:** The availability of excess tobacco fines that could be used to produce Cast Leaf was updated. Excess dust quantities for the full year 1992 declined due to reduced CT generation in USA factories and less dust recovery than anticipated in Western European factories. Also, a higher percentage of the PME dust was CTRL and winnowers that are usable in RL.

   Dust availability will increase if there is a drop in RCB demand, e.g., in light of legislated EEC tar reductions. There are also 2 million lbs/yr of South American lamina dust and a potential 4 million lbs/yr reclaimed USA stemmery dust (currently undergoing qualification tests). In summary, there are enough unutilized feedstocks to sustain 6–10 million lbs/yr of Cast Leaf. The capacity to produce this poundage would be available at the BL Plant if it were converted to NBL production.

   The declining availability of scraps and bright stems jeopardizes PM's overutilization of ES/IS, BBO and RL. Prices for these materials have been escalating ~10% annually, much more rapidly than leaf prices. On the other hand,

cast sheet feedstocks (dust and burley stems) are available at a relative bargain price. Leaf Department feels that other sources of dust could be tapped since there is almost no competition for this material.

PME would utilize an additional 4 million lbs/yr of cast sheet if Cast Leaf were available (additional RCB is unacceptable for taste and tar delivery). This would enable PME to use all of their recovered dust and would decrease their overutilization of scraps and bright stems.

The remaining 2–6 million lbs/yr of Cast Leaf is targeted for use by PM–USA; 4 million lbs/yr would equate to ~5% inclusion level if used only in price–value brands. Preliminary discussions with Leaf Blending indicate that Cast Leaf is neutral enough that it should be usable in blends.

Cast Leaf could also have applicability in EEMA region as a means to utilize byproduct dust from acquired/potential cigarette factories in Central Europe. Capital and operating costs for Cast Leaf would have to be low to be competitive with the relatively low blend costs and any existing reconstitution capacity. Since RCB demand in this area is very low, a Cast Leaf facility could be built without NBL capability; this would eliminate equipment costs associated with ammonia handling, aging and product cooling, and would provide reduced stack emissions. Discussions will be held with EEMA in second quarter in order to define needs and gather data for a business situation analysis.

Inquiries regarding Cast Leaf have also been received from Turkey and Brazil/Argentina.

2. **Plans:**
   - Continue with the Cast Leaf process/product development plan for completion in 1993.
   - The subjective target of Cast Leaf for PME use is an RL substitute.
   - Develop the business rationale for increased inclusion of cast type sheet with PM USA and PME Leaf Departments in April 1993.
   - Prepare an order of magnitude capital cost estimate for an EEMA Cast Leaf facility in the 2nd Quarter 1993 for review with EEMA management.

3. **Conclusions:** Cast Leaf presents a definite economic opportunity for the corporation and development should continue.

   The mode of Cast leaf utilization will be affected by sales volumes, product mix, OTM availability and OTM costs.

4. **Contributors:** Reconstituted Tobacco Development, Development Engineering, BL Plant, PM USA Leaf Department, PME Leaf Department, and PME R&D

B. **Strategy:** Develop a Cast Leaf product with the burn characteristics of RL.

1. **Results:** The main focus of development work was to find means of reducing the amount of guar below 10 parts/100 parts tobacco used to form a sheet with the

2050795628

physical strength of RCB and an acceptably neutral subjective character. The main problems encountered so far using guar gum were separation of the gum from the slurry during drying and the slow drying rate (~50% that of NBL). Three parallel efforts are being pursued to produce a low guar content Cast Leaf product: 1) Improved Slurry Homogenization, Steam Pressure Treatment, and Hybrid Formulations.

Slurry Homogenization was found to be a significant factor affecting the reduction of the quantity of guar needed for sheet formation. Sheet was formed with 2 to 4 parts of guar when processed through an Arde Barenco Dicon homogenizer. Some sheet blistering occurred only when using 4 parts guar. Another advantage of slurry homogenization being explored is elimination of the need for feedstock grinding which is a major cost factor for a new installation.

Steam Pressure Treatment of tobacco was demonstrated as a method to produce a slurry suitable for sheet formation. Production dust (95% < 120 mesh) and 2/1 ratio of production dust/burley stem blend (95% < 120 mesh) were treated with high pressure steam in sufficient quantities for pilot plant trials at the Herty Foundation in Savannah. Initial pilot plant trials demonstrated this as a viable means of sheet preparation without any added binder. The tobacco chemical changes effected by steam treatment are being investigated.

Hybrid Formulations were also investigated in the laboratory and the pilot plant. The objective of this approach is to reduced the quantity of guar gum in the formulation by utilizing reduced levels of DAP and ammonia (as compared to RCB) to achieve partial pectin release. The most promising approach may be to treat the burley stems with DAP and ammonia to release pectin and soften the tobacco structure, and combine this slurry with a production dust/2 parts guar slurry.

2. **Plans:**
   - Complete evaluation of slurry homogenization for reduction of binder in Cast Leaf.
   - Determine if slurry homogenization can substitute feedstock grinding.
   - Determine the burn rate and tar delivery of high pressure steam treated tobacco.
   - Determine the chemistry of steam treated tobacco.
   - Develop formulations to stabilize CL slurry during drying and increase drying rate.

3. **Conclusions:** CL with tensile strengths greater than RCB can be made with 2–4 parts of guar through increased with slurry homogenization.

   CL sheet quality made from 100% production dust is superior to CL with burley stem in a blend with production dust.

   High pressure steam treatment is a viable means of tobacco treatment in preparation for sheet formation.

4. **Contributors:** Reconstituted Tobacco Development, Flavor Technology, and Chemical Research

2050795679

5. **References:** G. D. Keritsis, "Cast Leaf – First Quarterly Report 1993," memo to G. Gellatly, February 8, 1993.

   S. E. Wrenn and J. D. Baggett, "Thermomechanical Processing of Tobacco," memo to G. Gellatly, March 17, 1987.

   J. D. Baggett, "Sunds Defibration Testing at the Herty Foundation," memo to G. Gellatly, February 8, 1993.

PROGRAM NAME : New Expanded Tobacco
PROGRAM COORD. : E. B. Fischer
PERIOD COVERED : First Quarter, 1993

Coordinator Summary: The first objective listed below was a carryover from 1992. Current results are very promising, and a March completion is expected. Product Support to Leaf has been very successful and will continue, as required, during the year. The major effort in 1993 will be the design and construction of a Short Cycle Impregnation Facility for International.

I. **Objective:** Determine a Tower System Design which will Ensure Successful Scale–Up of the NET Process.

A. **Strategy:** Develop a tower feed valve and separator which will provide maximum product expansion, uniformity, and subjective acceptability.

1. **Results:** A separator was built and tested which would fit into the Bermuda installation and incorporate some of the characteristics of the large, no recycle, plant slice separator developed in the pilot plant. This separator exhibited recycle. Modifications are being made in an attempt to improve its performance by reducing or eliminating recycle.

   A detailed evaluation of the current round tower design showed approximately 75% of total tower heat transfer occurs in the first 25% of the tower, indicating the initial tobacco/gas interactions are critically important. As reported below, an obloid (cornerless, rectangular) tower was designed and installed to improve initial tobacco/expansion gas contact. Although no significant difference was detected in a comparison of the close coupled cold feed valve with a standard feed valve on the round tower, it was judged to be important to design and install a modified close coupled feed valve on the obloid tower to minimize heat pickup by the tobacco infeed prior to the initial critical contact between the impregnated tobacco and the expansion gas.

2. **Plans:** Establish cold feed valve operating parameters for the obloid tower by March 1993. Complete evaluation of separator by March, 1993.

3. **Conclusions:** Although this work will be completed four months behind the original schedule, it will provide adequate time for testing at Bermuda during start–up.

4. **Contributors:** T. Clarke, A. Kumar, R. Lum, J. Washington, W. Winterson

B. **Strategy:** Determine the tower design and operating ranges which will ensure successful scale–up of the NET process.

1. **Results:** An obloid tower was installed to improve gas/tobacco contact and reduce or eliminate the previously demonstrated decline in CV with throughput in round

towers. Preliminary testing indicates the new tower is successful on both counts using DIET impregnated BLDET. However, equipment limitations have prevented the achievement of low tower exit OV at the highest throughputs. Modifications to eliminate these limitations have been completed.

Testing with NET has also been satisfactory on the obloid tower.

2. **Plans:** Test and evaluate high throughput results from the obloid tower by March 1993.

3. **Conclusions:** Although this work will be completed three months behind the original schedule, it will provide adequate time for testing at Bermuda during start–up.

4. **Contributors:** S. Barton, A. Kumar, R. Lum, R. Moffitt, E. Moss, W. Winterson

II. **Objective:** Provide Product Support to Leaf for NET Inclusion in Full Margin Brands.

Results: During this quarter, Process Development continued to support Leaf, Flavor Technology, and Cigarette Technology to develop use strategies for NET in Lark and Merit Ultima. POL's were made using NET in the following brands: Marlboro, Benson & Hedges, Benson & Hedges Menthol, Merit, and Merit Ultra Light. Shipment of these POL's are due by the end of March.

Plans: Continue expansion of blends of Bright, Burley, and Oriental as per request of Leaf.

Conclusions: NET utilization strategies continue to be directed by New Product Development with the Leaf Group developing the blends, Flavor Technology and Domestic Product Development grouping the products, and Process Development providing the NET products and cigarette fabrication as requested.

Contributors: C. Moogalian, J. Dobbs, D. Leister, B. Riggan, B. Peace, B. Taylor, T. Clarke, V. Covington, J. Atkinson, P. Grantham, G. Carter, W. Mokarry, G. Romig, G. Inge, Analytical Research, Materials Evaluation Lab, Semiworks Primary and Make Pack Personnel, Chemical Research, Flavor Technology, and R. Southwick

III. **Objective:** Develop Design Criteria for Conversion of DIET Facilities to the NET Process.

Plans: No major activity is currently planned for this objective during 1993, although due to problems encountered with current DIET impregnators, a NET capacity evaluation will be completed during March for both MC and Cabarrus locations. The purpose will be to determine pressure capacity requirements for potential spare vessels for each location.

Contributors: J. Dobbs

IV. **Objective:** Support Process Implementation of the Batch NET Process in Bermuda Hundred and BOZ.

Results: Continued interaction and support were provided to PM Engineering for the BOZ and Bermuda installations.

2050795682

A test of the expanded tobacco feed systems was conducted at Louisville and Cabarrus using expanded NET filler prepared in R&D. The test objectives were successfully met. The NET tobacco fed smoothly in Cabarrus with no problems. Some feeding problems occurred during the test at Louisville, but according to Louisville personnel, these were not attributed to the NET filler. As part of the tobacco feed systems evaluation, prizing of NET filler to various densities prior to shipment was tested. Preliminary results suggest NET can be prized to a density of about 5 pounds/cubic foot, but this requires confirmation.

Plans: Continue to interact with Engineering and Operating personnel as plant design continues. The prizing level for NET will be established by April 1993.

Conclusions: R&D, Engineering, and Manufacturing personnel continue to operate together as a team with areas that need attention being addressed.

Contributors: P. Barton, J. Dobbs, J. Tilly, B. Forkins, R. Lum, D. McDowell, M. North, M. Toerne, W. Winterson

V. Objective: Support the New Primary Technology Project to Reach 100 mg Weight Reduction.

Results: Close coordination with New Primary Technology and Leaf personnel has resulted in the development of several ET utilization strategies.

Plans: Efforts will continue toward the goal of 95% ET capacity utilization.

Contributors: J. Dobbs, M. Buchanan, M. Hoffman, T. Meade, C. Moogalian, C. Wood

VI. Objective: Develop a Short Cycle Impregnation Process for Use in Small Scale Expansion Systems for PM International.

Results: The software simulation package offered by Simons–Eastern Consultants, Inc. was selected to develop a dynamic model for the impregnation, CO_2 supply and recovery processes. Completion of the model is expected by the middle of April 1993.

Preliminary design of the SCI impregnator has been completed. We are soliciting quotations from the fabricators. Market research for small compressors required for the SCI Plant has been initiated.

Preliminary project scope and design criteria have been developed to design and construct a 500 lbs/hr SCI Commercial Plant. Value engineering for process design and engineering design criteria were conducted by M. W. Kellogg and Simons–Eastern, respectively. A proposal for engineering services has been received from each of these companies.

Another NET patent was submitted to include the Short Cycle Impregnation of NET at the higher bulk densities. A bulk density of 14 to 15 lbs/cu ft is expected to be used for the SCI Process.

Plans: Complete the development of the dynamic process model for impregnation and CO_2 supply, and recovery system. Begin detail design of the tobacco handling system for the impregnation process. Selection of the impregnator fabricator will

be completed. Review engineering proposals from Kellogg and Simons. Following selection of an engineering company, a 650 will be completed. An engineering company will be selected to design a small, skid mounted, SCI Commercial Plant for International application.

Conclusions: Development of the dynamic process model continues. Conclusion is expected by the middle of April 1993. The design and construction of a prototype facility has been scheduled for completion by the first quarter of 1994.

Contributors: D. Leister, J. Dobbs, K. Cho, W. Nichols, R. Prasad, W. Winterson

PROGRAM NAME : Operations Support
PROGRAM COORD. : R. N. Ferguson
WRITTEN BY : Contributors
PERIOD COVERED : First Quarter, 1993

Coordinator Summary: Some changes in the areas reported under this program will be found in the following report. Specifically, a section on Environmental Support, prepared by C. Hayward and a section on on–line and at–line analysis, prepared by B. Kanipe have been added to Operations Support this quarter. Following these sections, the remaining areas of support for leaf materials, support to materials evaluation, and support for finished product quality are included. Each of these sections is preceded by a brief section summary.

ENVIRONMENTAL SUPPORT

Summary: The installation of a pilot scrubber for removing the VOC from the BL Plant stack gases is on schedule. This scrubber is similar to the full–scale unit that Engineering would use for the Plant. It will be used to collect design information. Pilot testing of the biological process to treat the scrubber effluent continues. This process continues to perform very well under a variety of startup, shutdown, and restart scenarios.

The feasibility of using an anoxic biological process to denitrate KNO_3 is being studied. This process would destroy the KNO_3 converting the nitrate portion to nitrogen gas. The objective of this approach is to eliminate the need to sell the potassium nitrate.

Several methods for destroying the phosphine exiting from fumigations are being investigated. The use of a catalytic process to oxidize it appears to be the best current choice. Pilot testing is planned in July.

Analytical support of the Environmental Program continues. Updated TCLP procedures have been received and are being implemented. Effluent monitoring of factory and development equipment and air quality analysis continues.

I. Objective: Develop technology to reduce the levels of various components (nicotine, ammonia, and VOC's) in air emissions at the BL Plant to support Environmental Engineering in maintaining compliance at the site and preparing for future permitting requirements.

A. Strategy: Evaluate scrubbing technology for treating the air discharges.

1. **Results:** Preparations are being made for the installation of the a pilot scrubbing unit manufactured by Sly Manufacturing at the BL Plant. This unit is similar to that recommended for a full–scale system, so design and performance data will be obtained from the evaluation. Development Engineering is working with BL Plant personnel to arrange for the installation of the scrubber and the necessary piping and ductwork. The unit will treat about 2200 cfm of exhaust gas from the south main dryer exhaust.

A preliminary test plan has been developed for the evaluation based on results with the pilot packed scrubber and design information from Sly. The Sly unit has three stages, and tests will be run using 3, 2, and 1 stage to determine the effect of additional contacting. The design water blowdown rate, based on the packed scrubber data, will be 0.6 gpm. A range of water rates will be evaluated for each stage configuration.

Delivery of the Sly unit is expected in mid–March, with installation to be completed by the end of March. The pilot testing will require about one month, and during that period, an extended run at optimum conditions will be made for a complete week of BL Plant operations. Certified gas sampling and analysis will be conducted during this extended run.

Pilot testing has continued for a biological treatment process for the effluent from the pilot packed scrubber. A 100–gallon pilot sequential batch reactor (SBR) has been in operation for six months for this evaluation. Results have been excellent as the effluent consistently has no detectable nicotine, less than 1 ppm of ammonia nitrogen, and a chemical oxygen demand (COD) of less than 150 ppm.

During the past quarter, the system has been adapted to a lower COD feed resulting from a humectant reduction in the flavor system for RCB adopted in November. This resulted in lower PG content in the scrubber effluent, and the system adapted easily to the new feed. The system has also been operated with feeding only 5 days per week to simulate 5–day operation at the BL Plant, and the system adapted to this change as well. Detailed profiles for the various types of nitrogen in the system were developed during this testing.

All of this testing has shown that the microbial population is flourishing with the scrubber effluent and that the observed reaction rates and system behavior have corresponded to typical wastewater treatment system. Our consultant on this work, Dr. Joh Kang of McNamee Advanced Technology, has agreed that this treatability evaluation has been completely successful.

2. **Plans:** The Sly scrubber evaluation will start in April and should be completed in May. This will conclude the development work on the scrubbing process. The wastewater treatment effort will also be completed at about this time. The only remaining treatability parameter to be evaluated is temperature. The temperature effect on wastewater treatment systems is well understood, so this testing will only need to verify the expected reduction in treatment rates.

   A report will be prepared at the conclusion of the testing that will cover the packed scrubber evaluation, the Sly scrubber evaluation, and the water treatment development. This report will also present our recommendation to Engineering and the BL Plant on a scrubbing system.

3. **Conclusions:** Scrubbing and biotreatment of the wastewater continues to be a viable and attractive alternative for treating the BL Plant air discharges. No problems have been found with the wastewater treatment process.

4. **Contributors:** Reconstituted Tobacco Development and Development Engineering

2050795686

II. **Objective:** Develop technologies to reduce environmental concerns and costs associated with the disposal of waste sludge from the Park 500 RL process.

A. **Strategy:** Develop a biological denitrification process to treat the KNO_3 from the denitration process.

1. **Results:** This program is in the early planning stages at this point. The company that had previously purchased the KNO_3 coproduct went bankrupt and was sold last year. As a result of the effort involved in finding a new customer for the product, Park 500 Management has expressed interest in an on–site process to eliminate the material.

   The process being considered is a biological denitrification process in which the KNO_3 would be redissolved in wastewater from the plant. This water would then be treated under anoxic conditions (no dissolved oxygen) so that denitrification (the conversion of the dissolved nitrate into nitrogen gas) would occur.

2. **Plans:** Park 500 is currently quantifying their production rate for the KNO_3 product. Once this is determined, we will request a preliminary design from Dr. Kang as well as recommendations for necessary pilot testing. Based on this analysis, we will make further plans in cooperation with Park 500 Management.

3. **Contributors:** Reconstituted Tobacco Development

B. **Strategy:** Evaluate the feasibility of using a recrystallization step to improve the quality of KNO_3 .

1. **Results and Conclusions:** Recrystallization of the potassium nitrate has been shown to improve the quality of the coproduct. The crystal size of the potassium nitrate which was recrystallized with water and agitation was examined by SEM analysis. The recrystallized material had a crystal size of 30–300 microns which compares to a crystal size of 15–125 microns for the starting material. The concentration of the impurities in the recrystallized KNO_3 was about 10% of that in the currently produced material.

2. **Plans:** No additional studies are planned for potassium nitrate recrystallization.

3. **Contributors:** Product Research Division and Analytical Research Division

III. **Objective:** To support Environmental Engineering's development of a catalytic carbon process to oxidize phosphine. Evaluate alternate processes that have an economic advantage over the catalytic carbon process.

Results and Conclusions: In collaboration with Environmental Engineering, plans and respective responsibilities were clarified to achieve the stated objective.

A search has been conducted to identify suppliers of supported oxidation catalysts. This initial investigation has revealed that the major companies involved in catalytic chemistry are not experienced in the oxidation of phosphine. Two external companies, Engelhard Corporation and Johnson Matthey, specializing in catalytic chemistry, are being evaluated in more detail such that a contract to develop oxidation specific for phosphine can be obtained.

2050795687